

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : B29C 59/04		A1	(11) International Publication Number: WO 97/01431 (43) International Publication Date: 16 January 1997 (16.01.97)		
(21) International Application Number: PCT/US96/11086 (22) International Filing Date: 27 June 1996 (27.06.96)		(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TT, UA, UG, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).			
(30) Priority Data: 08/495,919 28 June 1995 (28.06.95) US					
(71) Applicant: HUYCK LICENSCO, INC. [US/US]; Suite 1300, 1105 North Market Street, Wilmington, DE 19801 (US).					
(72) Inventors: GSTREIN, Hippolit; Graben 25, A-2640 Gloggnitz (AT). MICHALEK, Walter; A-2630 Pottschach (AT).					
(74) Agent: SAUNDERS, Thomas, M.; Lorusso & Loud, 440 Commercial Street, Boston, MA 02109 (US).					
(54) Title: PROCESS OF MAKING PAPERMAKERS' FABRIC					
(57) Abstract					
A process for producing a papermakers' fabric, wherein the paper contacting surface of the fabric is molded between two preferably heated surfaces adapted to apply contact pressure to the fabric to optimally smoothen the paper contacting surface of the fabric and equalize caliper variations in the fabric. Preferably the two surfaces are surfaces of two cooperating rolls formed in a nip press. The fabric is passed through the nip press into engagement with the heated rolls thereby molding and smoothening the surface of the fabric.					
<p style="text-align: right;">D7 onward.</p> <p>No: Moisture</p> <p>Different pressure across width.</p> <p>Specific disclosure of sieve properties... void size etc</p> <p>Pressure adjustment for joined fibers at joint</p>					

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	GB	United Kingdom	MW	Malawi
AT	Austria	GE	Georgia	MX	Mexico
AU	Australia	GN	Guinea	NE	Niger
BB	Barbados	GR	Greece	NL	Netherlands
BE	Belgium	HU	Hungary	NO	Norway
BF	Burkina Faso	IE	Ireland	NZ	New Zealand
BG	Bulgaria	IT	Italy	PL	Poland
BJ	Benin	JP	Japan	PT	Portugal
BR	Brazil	KE	Kenya	RO	Romania
BY	Belarus	KG	Kyrgyzstan	RU	Russian Federation
CA	Canada	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic	KR	Republic of Korea	SE	Sweden
CG	Congo	KZ	Kazakhstan	SG	Singapore
CH	Switzerland	LI	Liechtenstein	SI	Slovenia
CI	Côte d'Ivoire	LK	Sri Lanka	SK	Slovakia
CM	Cameroon	LR	Liberia	SN	Senegal
CN	China	LT	Lithuania	SZ	Swaziland
CS	Czechoslovakia	LU	Luxembourg	TD	Chad
CZ	Czech Republic	LV	Latvia	TG	Togo
DE	Germany	MC	Monaco	TJ	Tajikistan
DK	Denmark	MD	Republic of Moldova	TT	Trinidad and Tobago
EE	Estonia	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	UG	Uganda
FI	Finland	MN	Mongolia	US	United States of America
FR	France	MR	Mauritania	UZ	Uzbekistan
GA	Gabon			VN	Viet Nam

PROCESS OF MAKING PAPERMAKERS' FABRIC

1 **Field of the Invention**

2 The present invention relates to papermakers' fabrics and
3 especially to papermaking fabrics for the dryer or forming
4 sections of a papermaking machine.

5
6 **Background of the Invention**

7 In the conventional fourdrinier papermaking process, a water
8 slurry or suspension of cellulose fibers, known as the paper
9 "stock", is fed onto the top of the upper run of a travelling
10 endless forming belt. The forming belt provides a papermaking
11 surface and operates as a filter to separate the cellulosic
12 fibers from the aqueous medium from the cellulosic fibers by
13 providing for the drainage of the aqueous medium through its mesh
14 openings, also known as drainage holes, by vacuum means or the
15 like located on the drainage side of the fabric.

16 After leaving the forming medium the somewhat self-
17 supporting paper web is transferred to the press section of the
18 machine and onto a press fabric, where still more of its water
19 content is removed by passing it through a series of pressure
20 nips formed by cooperating press rolls, these press rolls serving
21 to compact the web as well.

22 Subsequently, the paper web is transferred to a dryer
23 section where it is passed about and held in heat transfer
24 relation with a series of heated, generally cylindrical rolls to
25 remove still further amounts of water therefrom by evaporation.
26 Dryer fabrics are used in the dryer section of papermaking

1 machinery to support the moist paper web as it encounters the
2 heated rolls. Typically, the dryer fabric is formed into a
3 conveyor belt-like shape and incorporates at least a woven base
4 fabric with a smooth top surface for contacting the paper web.

5 The surface of the dryer fabric is determinative of the
6 marking characteristics found on the paper. If the surface of
7 the dryer fabric is smooth, the contact paper web will exhibit
8 less marking, thereby resulting in high quality paper. In
9 addition, a dryer fabric with a uniform and smooth surface
10 provides increased contact area between the web and the heated
11 rolls of the dryer section, thereby increasing the heat transfer
12 between the heated rolls of the dryer section and the paper web
13 and leading to more efficient sheet dewatering.

14 Thus, it has been a goal of the papermaking industry to
15 produce dryer fabrics with a smooth and uniform paper contacting
16 surface. The standard method for producing a dryer fabric with
17 these characteristics has been to provide a high fabric density
18 with weave patterns having long machine or cross machine
19 direction floatings. Another approach has been to form the dryer
20 fabric from flat monofilament materials in the machine direction
21 of the fabric.

22 Despite the attempts of the prior art, however, knuckles
23 formed at the crossing of the machine and cross machine direction
24 yarns invariably render the fabric prone to contamination and
25 marking, and prevent uniformly high heat transfer. Using flat
26 monofilaments has improved the heat transfer between sheet and
27 dryer roll by increasing contact area, but forms large
28 contamination traps according to the shape of the monofilament.

1 Thus, various impurities become trapped within these fabrics
2 causing highly undesirable marking characteristics.

3 These difficulties exist similarly in the production of
4 forming fabrics for the forming section of the papermaking
5 machinery. Forming fabrics, however, generally cannot be
6 manufactured with a high fabric density since large interstices
7 between fabric yarns must exist to ensure drainage of the aqueous
8 medium through the fabric. Thus, surface smoothness is achieved
9 in forming fabrics primarily by providing long floats on the
10 paper contacting surface of the fabric, and by performing various
11 grinding and treating methods. Invariably, however, knuckles
12 formed on the papermaking surface cause the forming fabrics to
13 suffer from the same deficiencies as discussed above in
14 connection with dryer fabrics.

15

16 **Summary of the Invention**

17 Therefore, one object of the present invention is to provide
18 an improved papermakers' fabric for use in the forming or dryer
19 section of the papermaking machine.

20 Another object of this invention is to provide a
21 papermakers' fabric having an improved surface, resulting in
22 better sheet quality.

23 Yet another object of the present invention is to provide
24 a papermakers' dryer fabric with an improved drying rate due to
25 improved contact between the paper web and the rolls of the dryer
26 section.

1 Still another object of the present invention is to provide
2 a papermakers' dryer fabric with less opportunity for
3 contamination due to missing knuckles.

4 These and other objects of the invention are achieved by a
5 process for producing a papermakers' fabric, wherein the paper
6 contacting surface of the fabric is molded between two preferably
7 heated surfaces adapted to apply contact pressure to the fabric
8 to optimally smoothen the paper contacting surface of the fabric
9 and equalize caliper variations in the fabric. Preferably the two
10 surfaces are the surfaces of two cooperating rolls formed in a
11 nip press. The fabric is passed through the nip press into
12 engagement with the heated rolls thereby molding and smoothening
13 the surface of the fabric.

14

15 **Brief Description of the Drawing**

16 The process for manufacturing fabrics according to the
17 present invention will be apparent from the following detailed
18 description of the invention, along with the drawings, in which
19 like reference numbers refer to like members throughout the
20 various views.

21 FIGS. 1-3 are unity textile design charts for illustrating
22 preferred embodiments of a dryer fabric for use in connection
23 with the present invention.

24 FIGS. 4-8 are machine direction sectional views of preferred
25 embodiments of a forming fabric for use in connection with the
26 present invention.

1 FIG. 9 is a diagram of a preferred system for performing a
2 surface molding operation on a papermaker's fabric according to
3 the present invention.

4

5 **Detailed Description of the Invention**

6 Generally, the invention relates to the manufacturing and
7 application of papermaker's fabrics for the forming or dryer
8 sections of a paper machine involving the step of surface molding
9 the fabric between heated surfaces to obtain an optimally uniform
10 paper contacting surface.

11 The fabrics manufactured according to the present invention,
12 as do most papermakers' fabrics, incorporate a woven fabric,
13 being either single or multilayer, e.g. monoplane, duplex, X-
14 weave, triple weft or triplex. The weave patterns and materials
15 for the fabric will be selected according to criteria such as
16 smoothness of the fabric surface against the sheet side and/or
17 wear resistance against the rolls.

18 FIGS. 1-3 are design charts which illustrate preferred weave
19 patterns for dryer fabrics which are particularly useful in
20 connection with the present invention. In these figures, Arabic
21 numerals 1-13 denote cross machine direction yarns, and numerals
22 13-18 denote machine direction yarns. The symbols "X" denote
23 locations where cross machine direction yarns are positioned over
24 machine direction yarns, giving long machine direction floats.
25 FIGS. 4-8 are machine direction sectional views of preferred
26 forming fabrics for use in connection with the present invention
27 wherein the machine direction yarns 19-20 are interwoven with
28 cross machine direction yarns 21-24.

1 As can be seen, the preferred weaves include long machine
2 direction yarn floats, i.e. machine direction yarns which travel
3 over two or more successive cross machine direction yarns without
4 diving back down into the fabric. FIGS. 1-8 represent
5 preferred, but not limiting weave patterns for dryer and forming
6 fabrics. The fabrics depicted in FIGS. 1-3 demonstrate preferred
7 weaves on either eight or twelve shaft. Different weave patterns
8 are used to match different permeability ranges for the dryer
9 fabrics according to their application in the warm-up, the main
10 evaporation zone, or the cooling zone of the dryer. Similarly,
11 different weave patterns for the forming fabrics may be used
12 according to predetermined criteria.

13 The conventional yarns utilized in dryer and forming fabrics
14 of the present invention will vary, depending upon the desired
15 properties of the fabric. Round shaped polyester-monofilaments
16 with diameters of 0.3mm to 0.6mm represent the preferred material
17 for the standard dryer fabric. Polyester and polyamide
18 monofilaments with diameter of 0.08mm to 0.4mm represent the
19 preferred material for standard forming fabrics. Nonetheless,
20 the yarns may be round, elliptic, or flat, and may be
21 multifilament yarns, monofilament yarns, twisted multifilament
22 and/or monofilament yarns, spun yarns or any combination of the
23 above. It is within the skill of those practicing in the
24 relevant art to select a yarn type, depending on the purpose of
25 the fabric, to utilize with the concepts of the present
26 invention.

27 Yarns selected for use in each layer of the woven dryer or
28 forming fabric of the present invention may be those commonly

1 used in dryer fabric or forming fabric base fabric layers. For
2 example, the yarns could be ryton, peek, cotton, wool,
3 polypropylenes, polyesters, aramids or polyamides or combinations
4 of these materials. Again, one skilled in the art will select
5 a yarn material according to the particular application of the
6 final composite fabric.

7 After weaving and joining, the dryer or forming fabrics of
8 the present invention are subjected to a finishing process.
9 Referring to FIG. 9, during the preferred finishing process, the
10 fabric 27 is surface smoothened by molding between two rolls 25,
11 26 configured in a nip press. At least one, preferably both
12 rolls 25,26 are heated by either a steam or oil source (not
13 shown). Also, in the preferred embodiment the rolls 25, 26 are
14 swimming rolls which provide uniform pressure and heat transfer,
15 giving the fabric a uniformly molded surface. In the molding
16 process, the fabric 27 is warmed on a heated roll(s) 25,26,
17 passed through the nip press formed by the rolls, and cooled.
18 This process is iteratively performed while continuously checking
19 caliper, permeability and imprints of the fabric surface to meet
20 desired specifications for the fabric.

21 Different fabric designs require specific molding procedures
22 which differ in temperature, loading, dwell time, passes, etc.
23 to obtain optimum surface smoothness. However, one pass of the
24 fabric between two rolls configured in a nip press at a
25 temperature of 150 °C, at a speed of 0.7 m/min and a loading of
26 20-150 kp/cm² represents a useful starting point. Nonetheless,
27 the optimum parameters will always depend on the type of fabric
28 used and the desired criteria for the final fabric. It has been

1 found, however, that the temperature used for the process is
2 typically between about 130 °C and about 240 °C. The speed at
3 which the fabric is passed through the rolls varies depending on
4 the design between 0.3 and 10 m/min. Likewise, the specific
5 loading used for the molding process varies between about 20
6 kp/cm² and 150 kp/cm². Typically, the fabric must be passed
7 through the rolls up to 10 times to meet the desired fabric
8 specifications.

9 In addition, although the preferred embodiment involves the
10 use of two heated rolls 25,26 it is also possible to heat only
11 one roll 25 or to use only one roll to press the fabric against
12 a flat plate (not shown) with either or both of the surfaces
13 being heated. Other variations are also possible as long as
14 contact pressure and heat are applied to the fabric between two
15 surfaces.

16 Thus, the described process provides a molded fabric
17 surface having optimum uniformity. In addition, caliper
18 variations which exist in prior art fabrics are equalized down to
19 the micro-scale and prominent fabric knuckles are eliminated.
20 Thus, a fabric having a molded surface according to the present
21 invention provides improved paper quality, less contamination,
22 and improved drying rates due to improved sheet/roll contact in
23 the case of dryer fabrics.

24 While the invention has been particularly shown and
25 described with reference to the aforementioned embodiments, it
26 will be understood by those skilled in the art that various
27 changes in form and detail may be made therein without departing
28 from the spirit and scope of the invention. Thus, any

1 modification of the shape, configuration and composition of the
2 elements comprising the invention is within the scope of the
3 present invention. It is to be further understood that the
4 instant invention is by no means limited to the particular
5 constructions or procedures herein disclosed and/or shown in the
6 drawings, but also comprises any modifications or equivalents
7 within the scope of the claims.

1 What is claimed is:

2 1. A process for manufacturing a papermakers forming fabric or
3 dryer fabric comprising:

4 providing a woven fabric of interwoven cross machine
5 direction and machine direction yarns; and

6 molding a paper contacting surface of said fabric by passing
7 said fabric between two surfaces adapted to apply contact
8 pressure to said fabric, at least one of said two surfaces being
9 a heated surface.

10

11 2. The process according to claim 1, wherein at least one of
12 said two surfaces comprises a surface of a roll.

13

14 3. The process according to claim 2, wherein said roll is a
15 swimming roll.

16

17 4. The process according to claim 1, wherein said two surfaces
18 comprise surfaces of two cooperating rolls configured in a nip
19 press, and said paper making surface is molded by passing said
20 fabric through said nip press.

21

22 5. The process according to claim 1 wherein said paper
23 contacting surface comprises long machine direction floats which
24 cross over at least two of said cross machine direction yarns
25 successively before descending between others of said cross
26 machine direction yarns.

1 6. The process according to claim 1, wherein said at least one
2 of said two surfaces is heated to a temperature between about 130
3 °C and 240 °C.

4

5 7. The process according to claim 1, wherein said fabric is
6 passed between said two surfaces at a speed between about 0.3
7 m/min and 10 m/min.

8

9 8. The process according to claim 1, wherein said fabric is
10 passed between said two surfaces at a specific loading between
11 about 20 kp/cm² and 150 kp/cm².

12

13 9. The process according to claim 1, wherein said two surfaces
14 comprise surfaces of two cooperating rolls configured in a nip
15 press, said rolls being heated to about 150 °C, and wherein said
16 fabric is passed through said nip press at a speed of about 0.7
17 m/min.

18

19 10. A process for manufacturing a papermakers forming fabric or
20 dryer fabric comprising the steps of:

21 (1) providing a woven fabric of interwoven cross machine
22 direction and machine direction yarns; and

23 (2) molding a paper contacting surface of said fabric by
24 passing said fabric between two surfaces adapted to apply contact
25 pressure to said fabric, at least one of said two surfaces being
26 a heated surface;

27 (3) cooling said fabric;

1 (4) checking said fabric for compliance with desired
2 specifications; and

3 (5) iteratively performing steps (2) through (4) until said
4 fabric complies with said desired specifications.

5

6 11. A papermakers fabric manufactured according to the process
7 of claim 1.

8

9 12. A papermakers fabric manufactured according to the process
10 of claim 10.

1/4

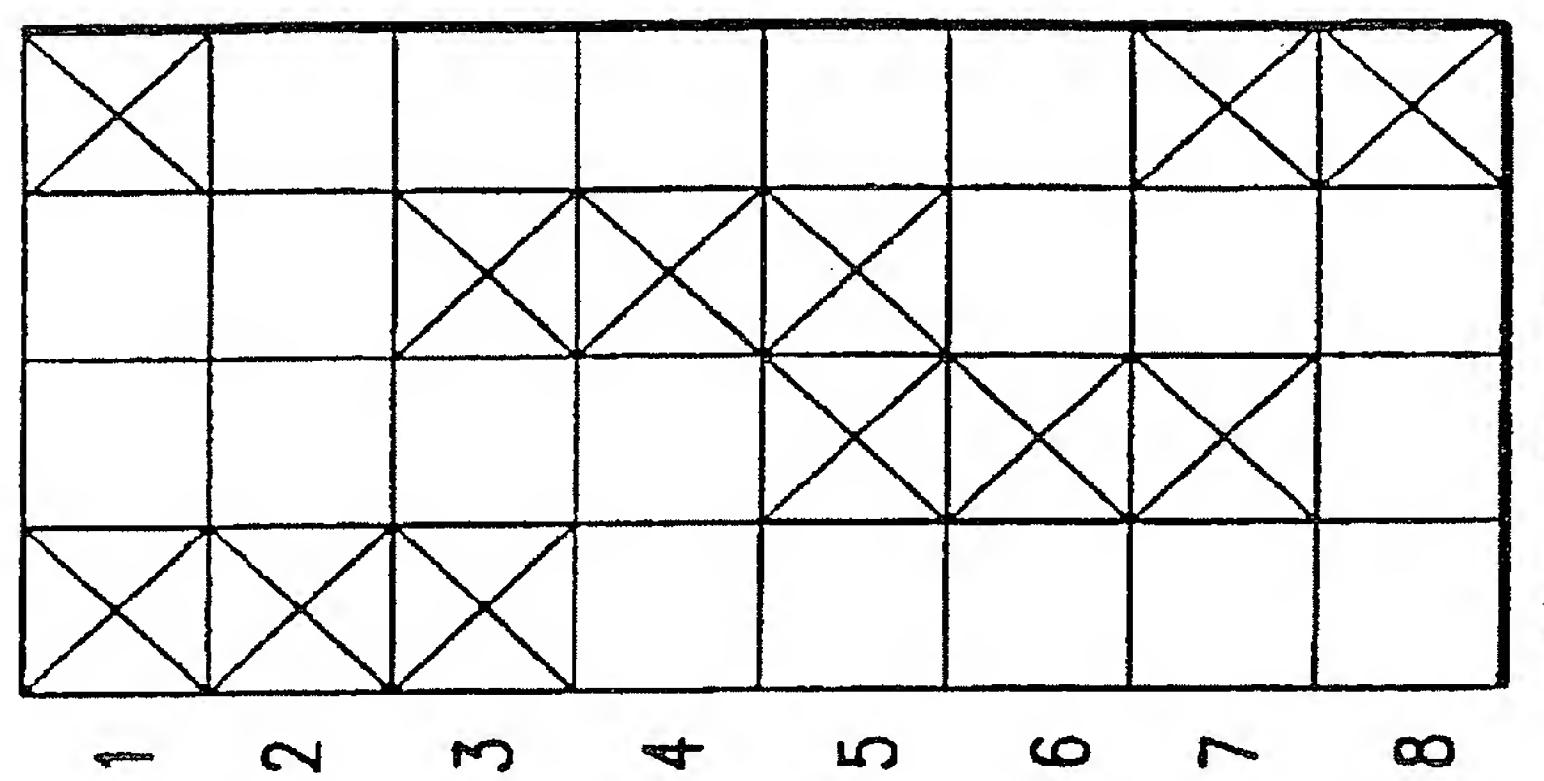


FIG. 3

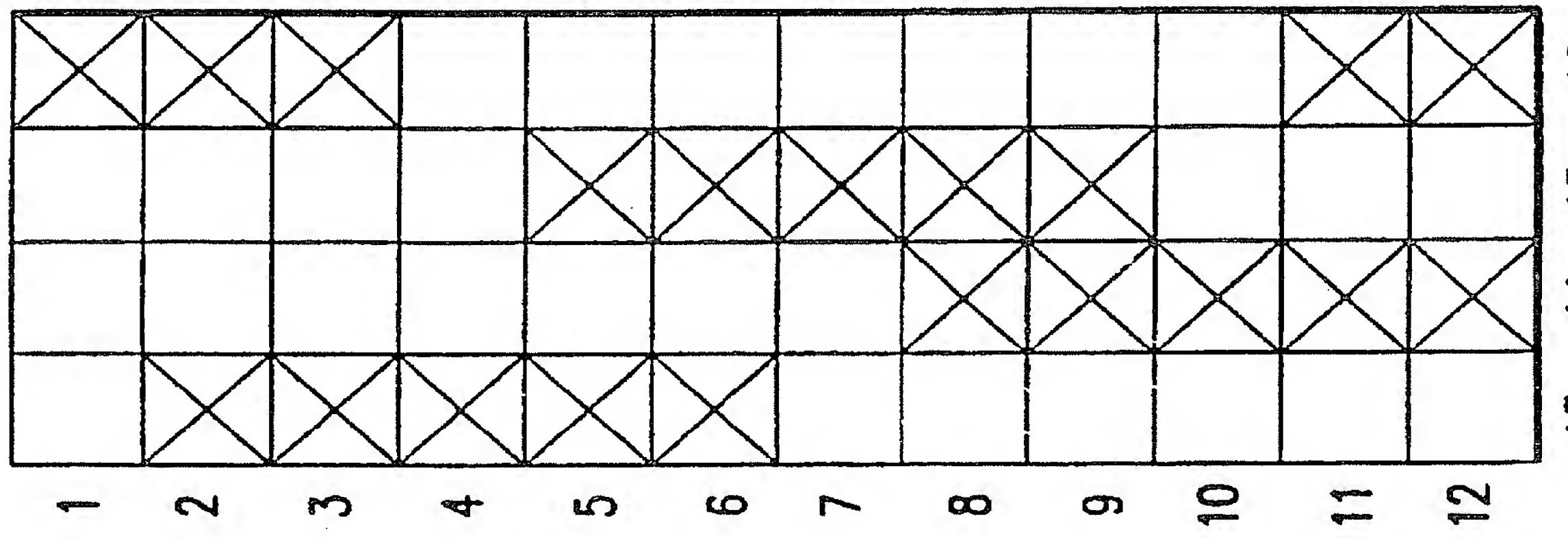


FIG. 2

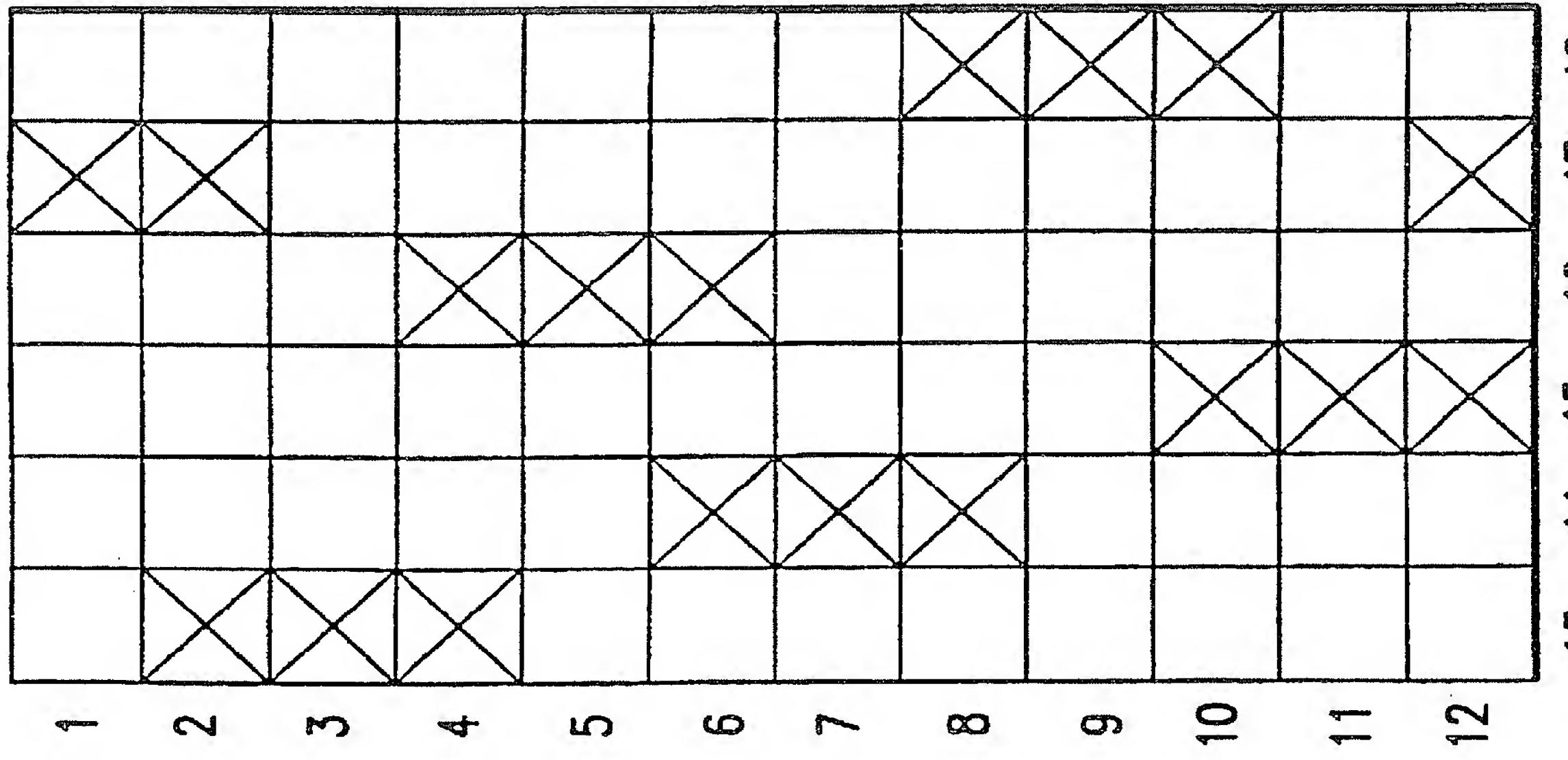
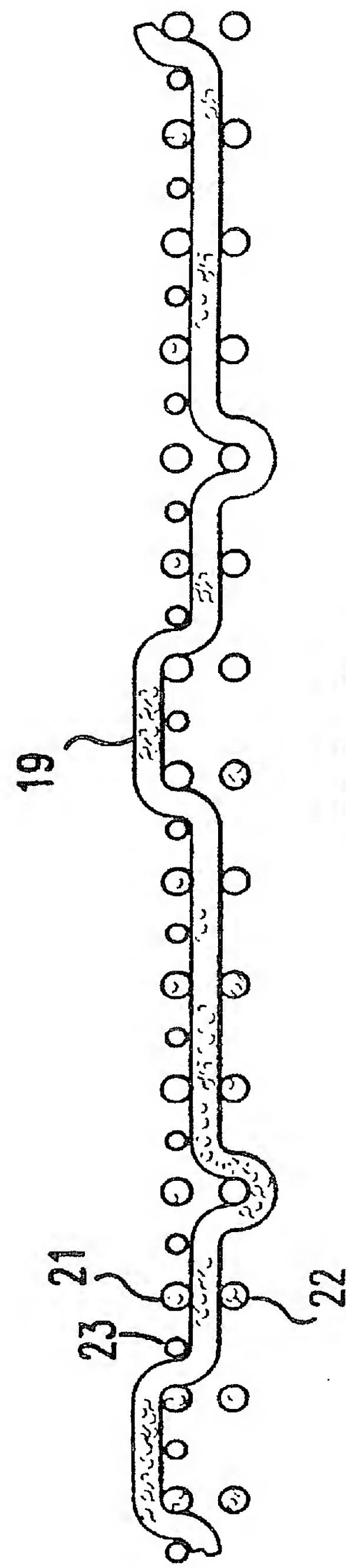
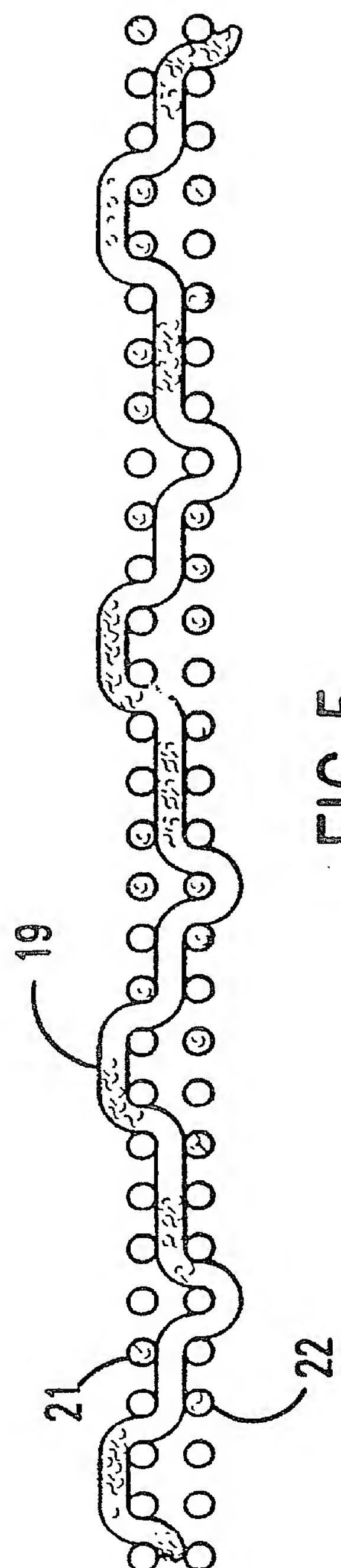
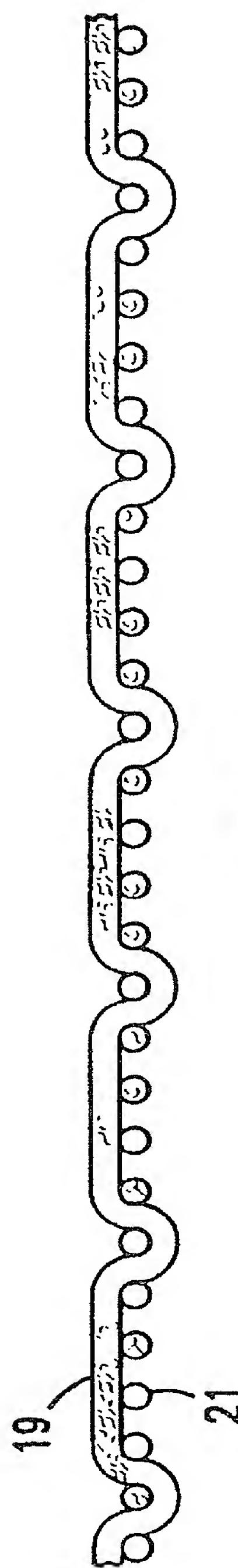


FIG. 1



3/4

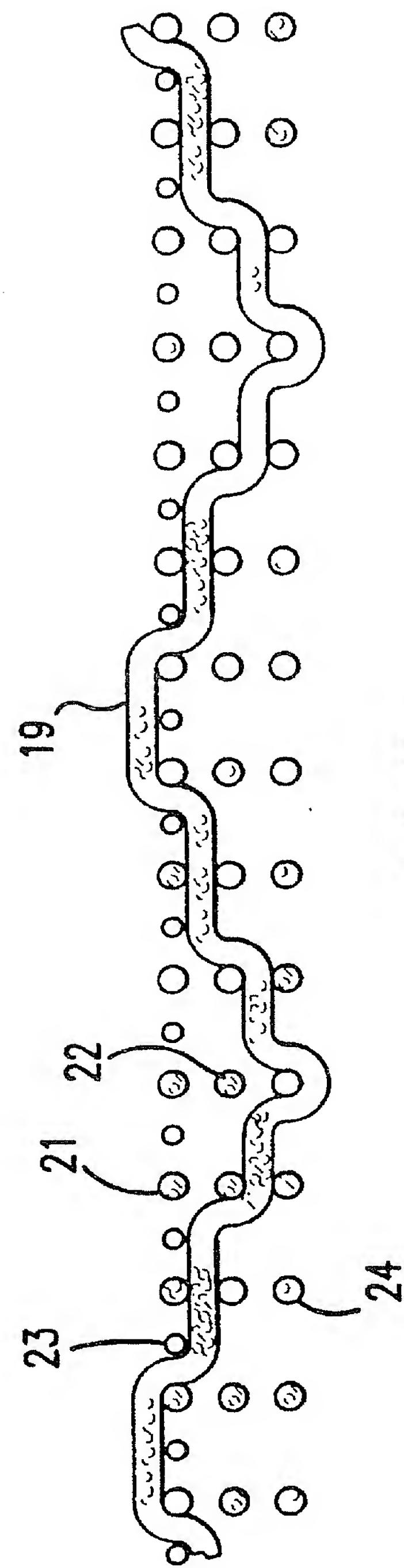


FIG. 7

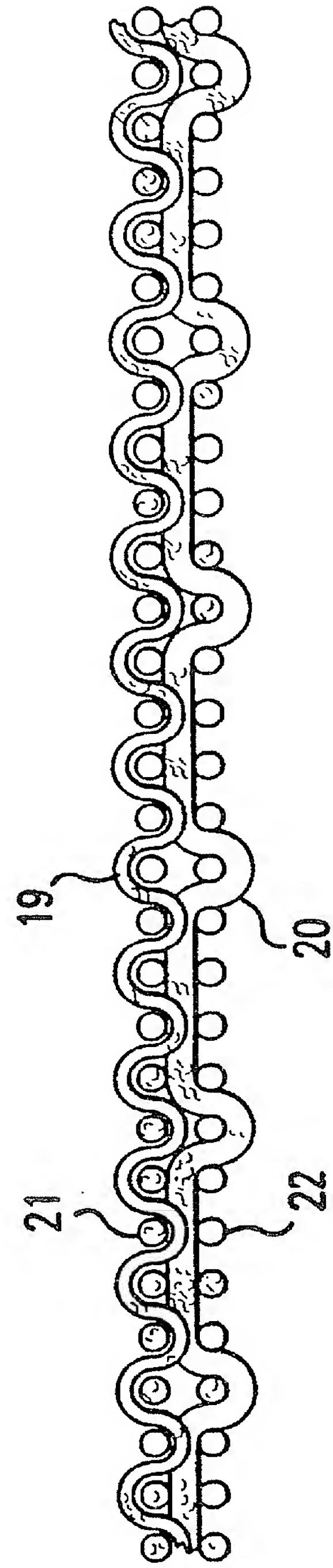


FIG. 8

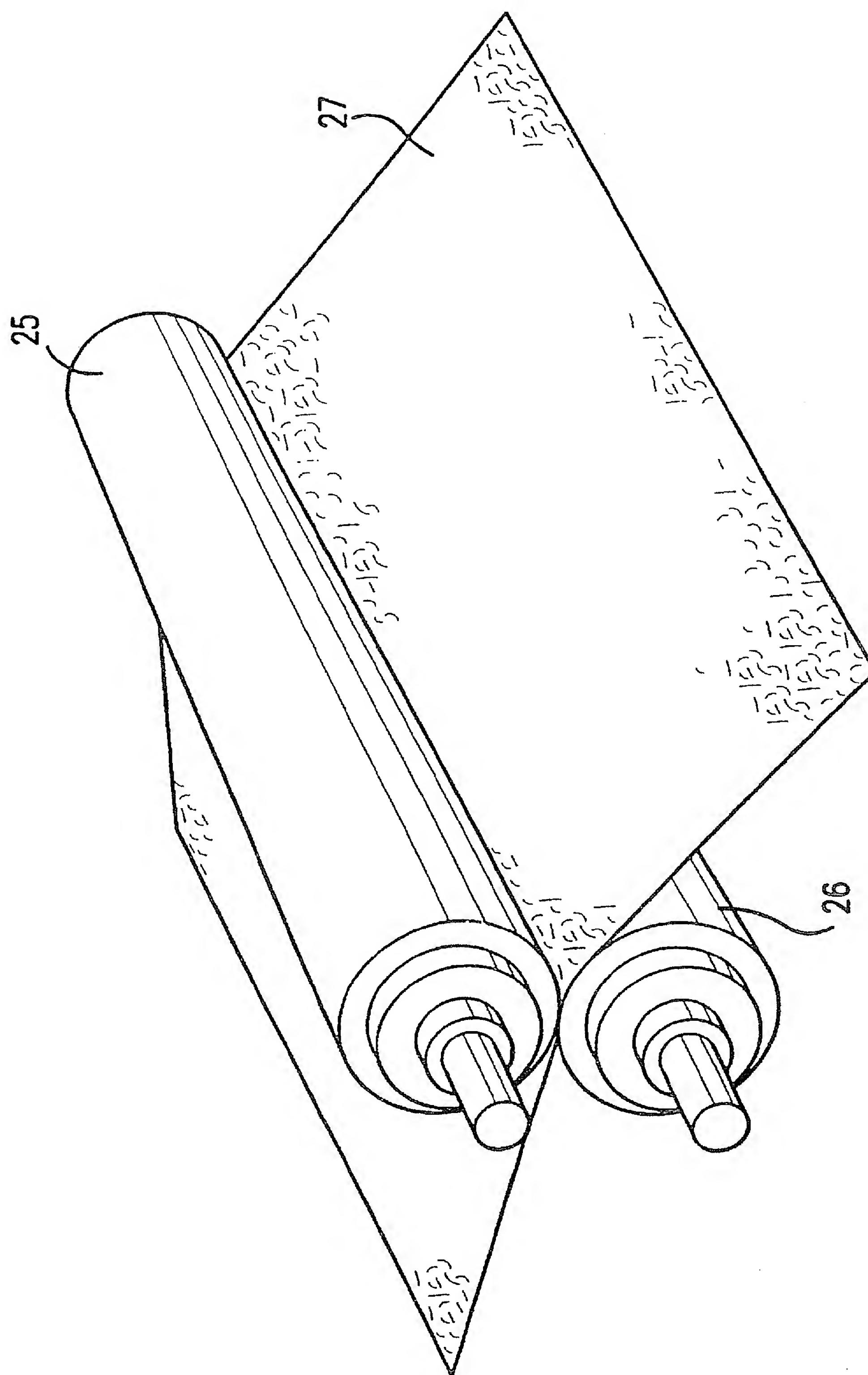


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US96/11086

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B29C 59/04

US CL :264/40.1, 280, 284; 428/224, 225

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 264/40.1, 175, 280, 284; 428/224, 225

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,407,737 A (W. HALTERBECK ET AL) 18 April 1995 (18.04.95), column 1, lines 5-34 and column 2, lines 12-51.	1-12

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
E earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
L document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
O document referring to an oral disclosure, use, exhibition or other means		
P document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

04 SEPTEMBER 1996

Date of mailing of the international search report

02 OCT 1996

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized Officer
Lebbie Thomas
LEO B. TENTONI

Telephone No. (703) 308-3834

